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(SeLScope)

Sustainable eLearning in a Changing Landscape: A Scoping Study (SeLScope)

A report prepared by the Higher Education Academy Supporting Sustainable eLearning Special Interest Group (SSeLF SIG¹)

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23rd December 2010

¹Now the UK Higher Education Academy Technology Enhanced Professional Learning Special Interest Group

Approaches to Sustainable E-Learning in a Changing Landscape: A Scoping Study (SELScope)

Executive summary

We live in an era of austerity in education. The sustainability of e-learning in Higher Education is a timely topic for discussion due to new challenges facing the sector. Financial constraints, commitment to quality standards and rapid technological development are all impacting upon universities, how they maintain their status as organisations that lead the generation of knowledge and as learning providers. Is this position tenable in the future? This report aims to contribute to the ongoing debates by scoping the concept of sustainability in e-learning and investigating possible approaches towards sustainable teaching and learning in the Higher Education (HE) sector. The report is relevant to e-learning researchers working in related areas. Practitioners, managers or policy makers may find the report a useful navigation tool to chart their way through empirical studies in the area of sustainable e-learning.

The report begins by exploring the concept of sustainable e-learning - defining it and establishing its characteristics in the context of Higher Education. To ensure a sound and systematic process, the review is informed by a five-phase methodological framework for scoping reviews by Arksey and O'Malley (2005). Examples and perspectives on the concept of sustainable e-learning are summarised and key factors impacting on sustainability are abstracted. highlights potential gaps and suggests directions for further research on the topic. The key messages emerging from the study are the following:

Firstly, the conceptual and empirical literature included in the study can be described as narrow and disconnected in its approaches discussing sustainability. Most of the works consider a rather limited number of elements associated with the concept of sustainability without taking cognisance of the whole. Adoption of less narrow perspectives is suggested here to enable better understanding of the inter-related nature of elements affecting sustainability of e-learning practice.

Secondly, the application of research methods suitable for long-term evaluations is relatively sparse. This commonly observed constraint limits the studies in deriving conclusive answers. This report suggests employing methodologies that can allow extending the discussions and distinguishing short and long term benefits and disadvantages. Action research or design-based research are among the approaches that can enhance the research on sustainable e-learning. Likewise, there are relatively few studies that combine and synthesise empirical work. The methodological affordances provided by meta-analysis or systematic reviews may shed further light on the subject under study and improve the generalisability of research outcomes.

Thirdly, empirical research that addresses the tensions between the concepts of cost-efficiency, effective pedagogy, and continuous innovative practice is limited. Although some tensions (e.g. costs versus effectiveness) are being studied, more research is needed to address the commonly perceived trade-offs or reinforcements. Further research in this direction can extend the discussion of sustainability to include perspectives of various stakeholders (e.g. administrators, teachers, researchers and students) involved and priorities taken.

Finally, there appear to be broad areas that require further research but carry a potential to sustainable e-learning practice. Some of these areas are highlighted in the report. Networks and collectives, along with techniques for developing greater understanding of their dynamics and structures, are particularly promising for providing insight into teaching and learning, and extending the sustainability debate. Mobile learning is another rapidly developing area that has a great potential for successful integration into formal education. Finally, the OER movement continues to contribute to implementation of novel business models that may contribute to sustainability debate. Further consideration of these areas may extend the discussion on sustainable e-learning practice bringing new perspectives into the debate.

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1 Aims and Objectives

This report summarises the outcomes of a scoping study of current approaches to sustainable e-learning in Higher Education, in the UK and beyond. The scoping study was conducted as part of the UK Higher Education Academy (HEA) Supporting Sustainable eLearning Forum Special Interest Group (SSeLF SIG - see Appendix 1). The aim of the report is to scope empirical studies in the area of e-learning that demonstrate and discuss sustainable forms of teaching and learning. It aims to highlight emerging issues in the research area and identify gaps in the literature on sustainable e-learning practice for future research.

The objectives were to:

- Objective 1: Explore the concept of sustainability and establish a foundation for the scoping review of sustainable e-learning practice. Identify a working definition of sustainable e-learning and set operational domains for conducting the scoping study. Highlight key dimensions for evaluating and measuring sustainability in e-learning.
- Objective 2: Conduct a review of the literature and subsequently assess, collate and synthesise the reviewed studies. Derive the emerging themes and evident issues of sustainable e-learning.
- Objective 3: Discuss the issues in sustainable e-learning that are the most prominent in the reviewed literature.
- Objective 4: Identify and discuss the issues that require further research.

The report will be of relevance to researchers and practitioners interested in the topic of sustainability of e-learning in Higher Education.

2 Introduction and Rationale

The global economic crisis has resulted in widespread cuts in government funding and other investment (T. Bates, 2010). The Higher Education (HE) sector across Europe is being negatively affected, with most European countries announcing reductions in Higher Education funding (EUA, 2010). According to European University Association, for example, Latvia implemented funding cuts of 48% in 2009, with a further 18% reduction planned for 2010. Cuts ranging from 5 to 10% are being implemented in Italy, Estonia, Ireland and Romania. Eastern European countries, including the Czech Republic, Poland, Croatia, Serbia and Macedonia, have also experienced up to 5% cuts. In the Nordic countries, Austria and Spain, no direct cuts have been announced yet, but there is the possibility of a reversal of commitments to increase budgets and raise student numbers (EUA, 2010). Substantial funding cuts of 40% by 2014-15 were announced in the spending review by the British Government (Morgan, 2010).

Similar patterns can be observed beyond Europe. The Australian Higher Education sector will implement 20% budget cuts in 2011-2012 and Australian universities are expected to adjust to funding cuts while remaining committed to high quality standards (Nicol, 2010). In the US, the

state of California reduced HE funding by 6.8% in 2009-2010 (Toohey & Gross, 2010). To cope with funding shortfalls, many universities in California, including the largest California State University (CSU) and the University of California (UC), are reducing the student intake, raising the fees and introducing pay cuts (Chen, 2009). In Canada the developments appear more positive, with the annual budget for Higher Education increased by \$32 million. However, this does not compensate for an earlier, more severe cut of \$150 million in 2009.

To buffer the effects of funding cuts, governments are seeking efficiency gains. For example, funding cuts of £915 million announced by the Higher Education Funding Council of England (HEFCE) in December 2009 will be implemented over a three-year period to try to ensure efficiency savings across the sector. Institutions are expected to minimise the impact of funding cuts on teaching quality while, at the same time, protecting research programmes through improved resource management and planning (Morgan, 2009). Another strategy is the selective allocation of funding in ways that require institutions to implement strategic changes that result in efficiency gains (Birchard, 2010).

Simultaneously, governments are seeking ways of generating income. For example, in the UK and the Netherlands, income generation measures, such as raising tuition fees, have been considered alongside reducing student grants (Funnekotter & Walters, 2010). However, this strategy is controversial and highly dependent on public support.

In addition, many universities across the world are trying to increase recruitment of international students to maintain financial viability. The US, followed by the UK, France, Germany and China, are leading the way in international recruitment. China set a target to increase the number of international students to half a million by 2020 (Brown, 2010), which will make it a leading recruiter of international students, by attracting more students into the country than they send out (Baty, 2010).

Funding cuts are forcing universities to consider their reputation, since this directly impacts on their ability to attract students (Brown, 2010). International and domestic students alike, faced with the prospect of paying fees rather than receiving scholarships, are carefully evaluating the value they receive for their money. Student opinion affects institutional ranking, stimulating universities to improve the quality of their provision and enhance their reputation (Baty, 2010).

Other strategies to generate income through increased student numbers include adopting flexible approaches to learning and teaching. The number of universities that offer fully online courses is growing. As more people combine work and study, part-time and distance education is likely to increase too (Cable, 2010). The availability of flexible programs provides potential benefits not only for the education sector but also for the industry. The flexibility of online education opens up greater possibilities for employer-development programmes that companies and organisations may wish to offer to their employees.

In addition to income generation, educational institutions pay considerable attention to student employability - the ability to progress into employment. The British Government in particular promotes and encourages educational institutions to work towards increasing student employability. While the concept of employability is not directly related to income generation, employability rates may affect institutional reputation or distribution of public funding. Hence, educational institutions are encouraged to work more closely with companies and organisations - progressing towards, ideally, a synergistic relationship between the industry and academia.

However, a growing body of research argues that the use of technology or implementation of innovative teaching methods does not necessarily lead to economic or pedagogical benefits (Njenga & Fourie, 2010; Oliver & Conole, 2003). In fact, some studies suggest that the use of

technologies can sometimes increase the costs of teaching, without commensurate benefits (Guri-Rosenblit, 2005; Laurillard, 2007). The subtle interplay between costs and benefits was a central aspect of the 'Managing for Sustainability' study (JISCInfonet, 2004) commissioned by the UK Joint Information Systems Committee (JISC)², and will form an important element of the discussion in this report.

One proposed cost saving solution has been the reuse of educational materials. The rationale is that the open sharing of educational resources increases access to knowledge. There is a view that opening access to learning resources may provide universities with competitive advantage, by improving their external reputation (Hylén, 2006). The 'open access movement' has gathered supporters and started a number of initiatives, organised conferences and disseminated information and resources. The Capetown Open Declaration (2007) is one such initiative that constitutes an important step towards open education, by fostering open education policies at governmental and institutional level. An important element in this initiative is the concept of Open Educational Resources (OER). The Capetown Declaration urges educators worldwide to develop a large pool of educational resources that are openly available. It has been argued that OERs offer great potential for reducing development costs and enhancing quality of resources (Downes, 2007).

Implementation of e-learning that is both sustainable and scalable requires a range of strategic considerations related to the development, reuse and ongoing maintenance of educational resources (Littlejohn & Pegler, 2007). A UK Joint Information Systems Committee (JISC)¹ funded initiative, the Designing Sustainability InfoKIT³, was one of the earlier attempts to guide practitioners in the design of sustainable approaches to e-learning. While e-learning may offer solutions for flexible, personalised or inclusive education (Ravenscroft, McAlister, & Sagar, 2009), the integration of educational technology into teaching and learning practice requires not only development of educational resources, but careful consideration of the pedagogical design (Littlejohn, 2003a; Mayes, et al., 2009). Laurillard (2007) called for an even deeper understanding of the relationship between anticipated benefits and costs of e-learning. She argued that achieving sustained improvements in learning through the use of e-learning technologies requires careful planning and management of available resources.

The notion that learning could be revolutionised by the introduction of Web2.0 tools has not yet been realised. Web2.0 supports the sourcing and aggregation of knowledge and information. The rapid growth in membership of social spaces such as Facebook, Twitter, delicious and many other sites provides evidence that web-based social networking facilities are becoming mainstream (Jacobs & Polson, 2006). Strategies for incorporating Web2.0 tools into teaching and learning can enhance sustainable e-learning practice, through community building, content sharing and reuse (S. Monge, Ovelar, & Azpeitia, 2008). Web 2.0 technologies could enable adaptive and self-regulated e-learning practices. However, at a time when the HE sector is facing change, understanding how the perceived benefits of Web2.0 can be embedded within education practice is a key concern.

This scoping study reviews current trends related to sustainable e-learning within the literature. This study aims to identify factors that lead to sustainability within e-learning. The report scopes the concept of sustainable e-learning within Higher Education and challenges the current understanding of the concept. The study is particularly appropriate given that the current (financial) climate in Higher Education means institutions will face increasing challenges to continue to meet the requirements and expectations placed upon them.

² Joint Information Systems Committees (JISC) - <http://www.jisc.ac.uk>

³ InfoKIT Designing for Sustainability, subject overview on the JISC Website:

<http://www.jiscinfonet.ac.uk/InfoKits/effective-use-of-VLEs/designing-for-sustainability>

3 Methodological Approach

A scoping study is a type of literature review that identifies underpinning concepts and maps the research literature in the field of interest (Mays, Roberts, & Popay, 2001). Scoping studies (or scoping reviews) constitute a broad and deep approach; a comprehensive study of the available literature complimented by consultation with selected individuals (Arksey & O'Malley, 2005). This approach is useful in identifying emerging themes and trends in diverse and extensive bodies of scientific knowledge (Rumrill, Fitzgerald, & Merchant, 2010). A detailed account of the methodological approach underpinning this study is available in Appendix 2.

The concept of “sustainability”, which has been utilised in a range of fields, runs the risk of being over-used and applied in simplistic ways. Sustainability is a multi-faceted concept involving a multitude of dimensions that can be studied from a number of different perspectives. The literature on e-learning sustainability is similarly diverse and dispersed. Therefore, a scoping review is a relevant method to identify and abstract factors that lead to sustainable e-learning.

3.1 Roadmap of the Review

To ensure a systematic approach, this study employs a five-phase methodological framework proposed by Arksey and O'Malley (2005). This framework is particularly suitable for analysis, synthesis and further appraisal of a contrasting body of studies (K. Davis, Drey, & Gould, 2009). Our inquiry was conducted in the following five distinct phases:

Phase 1: Explore the concept of sustainability to capture its extent, range and nature and operationalise the concept within e-learning context (see Appendix 3 for details). This phase can be further divided into five consecutive sub-phases (steps) as follows:

- Step 1.1: Conduct an initial review to explore and gain an overview of the variety of approaches employed in sustainable e-learning research.
- Step 1.2: Adopt a working definition for the term sustainable e-learning based on the initial review.
- Step 1.3: Identify operational domains of sustainability studies.
- Step 1.4: For each of the domains, compile a set of factors commonly considered in sustainable e-learning research.
- Step 1.5: Referring to the identified factors compile a set of keywords suitable for searching the literature. Identify electronic databases, web services and journals to be used for searching the literature.

Phase 2: Conduct a comprehensive search to identify relevant studies that demonstrate and discuss sustainable e-learning practice for each of the operational domains.

Phase 3: Define and apply inclusion and exclusion criteria to all the identified studies.

Phase 4: Chart the data, conducting data extraction, synthesis and interpretation of the material and compile a spreadsheet that summarises the data (see Appendix 5).

Phase 5: Collate and report the results in relation to the operational domains, discussing most prominent issues of sustainable e-learning and identifying knowledge gaps in the area.

3.2 Data Sources

The literature search was conducted using the British Education Index (BEI), Australian Education Index (AUEI) and the Education Resources Information Center (ERIC) databases. BEI covers over 500 English and European journals and includes over 150 thousand records to journal and conference papers, research reports and electronic texts (Sheffield, 2005). The AUE index provides a similarly wide range and volume of academic literature. The ERIC database, on the other hand, indexes papers from journals published by houses such as Elsevier, Sage and Routledge and resources that appear in various conference proceedings. ERIC is considered to be the most important database for searching and browsing educational literature (Hertzberg & Rudner, 1999). The search of the literature performed as part of this study was limited to publications between 2000 - 2010; covering a recent yet sufficiently broad body of literature. In addition, search through Google Scholar was employed to ensure consideration of a wider pool of literature and to reduce the possibility of missing key references.

4 Results and Findings

Presentation and discussion of the results and findings of the scoping study is structured around the phases of the methodological framework.

4.1 Exploring Sustainability in E-learning

4.1.1 What is Sustainability?

The concept of sustainability stretches across a number of academic disciplines but is most closely aligned with the field of environmental science. Reaching beyond its environmental definition, the concept has been considered from a variety of perspectives, including philosophical, historical, economic, political, social and cultural (Becker, Jahn, & Stiess, 1999). Given the multitude of perspectives and contexts in which the term 'sustainability' is being used, its meaning varies widely throughout the literature. This study, initially, explored the notion of sustainability by adopting a wide perspective. The detailed account that discusses the etymological and ecological perspectives on sustainability is presented in Appendix 3. The inquiry highlighted the need for a clear definition (B. Brown, Hanson, Liverman, & Merideth, 1987) and demarcation of factors required to identify sustainability (Shearman, 1990).

4.1.2 Towards a Definition of Sustainable E-Learning

The discourse on sustainability within the context of education is developing in two broad directions, which focus on either: [a] education for sustainability or [b] sustainability of education. Education for sustainability aims to address issues of environmental sustainability through educational solutions (Bourn & Shiel, 2009; Dawe, Jucker, & Martin, 2005; Sterling,

2001). Sustainability of education focuses on the implementation of sustainable forms of 'successful' practice through educational development, leadership and innovation (Davies & West-Burnham, 2003). Despite these two differing foci, the term 'sustainable education', is commonly used throughout the literature. Given the stated aims and objectives, this study was concerned only with the notion of sustainability of education.

Having determined that the focus should be around sustainability of education, the study explored definitions of, and approaches to, sustainability adopted in the education literature. The review of definitions of sustainability sourced in the literature, their foci, and limitations is discussed in Appendix 3. These definitions were often narrow in focus and, therefore, not suitable for use in a study that aims to scope the literature and broadly map the empirical research on sustainable e-learning. Therefore, on the basis of the review, a broader working definition was adopted:

Sustainability is the property of e-learning practice that evidently addresses current educational needs and accommodates continuous adaptation to change, without outrunning its resource base or receding in effectiveness.

This definition is sufficiently general and inclusive to capture the understanding that most authors seem to have of sustainability in the context of e-learning.

4.1.3 Domains, Levels and Themes of Sustainable E-learning

Inspired by the successful unification of concepts brought together in the ecological perspective on sustainability and integrating the overlapping three-pillar approach (see Appendix 3) employed for discussing sustainability of e-learning practice (Attwell, 2004; Lorenzo & Moore, 2002), this study identifies three operational domains of sustainable e-learning. These domains are: Resource Management, Educational Attainment and, Professional Development and Innovation (see

Figure 1). The domains were derived by exploring the sustainability literature and adopting a systems perspective on teaching and learning. Considering the components of an instruction system (comprised of teachers, learners, resources and environment) with outcomes and processes of their interaction (Dick & Carey, 2001) enables derivation of first principles. Both domains are necessary - encompassing: educational outcomes; resources used; and a feedback loop to support further improvement. The three operational domains represent a dynamically inter-related structure. The framework can be used to support discussion of sustainable e-learning on macro-, meso-, and micro-levels (Jones & Dirckinck-Holmfeld, 2009; Jones, Dirckinck Holmfeld, & Lindström, 2006) which correlate in HE to global, institutional and implementation/programme levels. Each of the levels and operational domains are explained below, with reference to their relevance to understanding the issues of sustainability in e-learning.

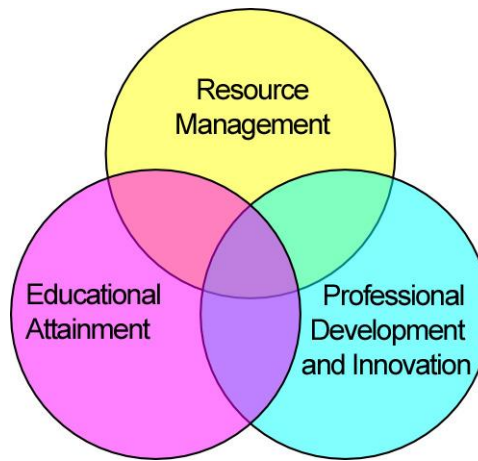


Figure 1: Sustainability of an educational system.

The integrated components of the framework represent areas of specific interests. Serving as operational domains, they enable the literature review to focus on a limited number of factors associated with sustainability. Conducting a review that operates from one domain at a time allows greater feasibility of, and control over, the study.

Resource Management: The operational domain of Resource Management includes literature on the resources required for the successful design and practice of e-learning. The issues considered within this domain include: staff time, costs associated with the choice of technology and media, economies of scale and scope. The domain focuses mainly on cost-effective measures and techniques for aiming towards sustainable e-learning practice.

The costs of introducing and delivering e-learning solutions have long been in the research spotlight. A range of studies focused on calculating costs vary in their approaches. Attempts were made to categorise these approaches on the basis of, for example, institutional and cross-institutional aspects of costing (Laurillard, 2007).

The determinants of cost-effective practice may vary too. One of the determinants of cost-effectiveness is through the achievement of economies of scale via, for example, the sharing and re-use of educational resources. Consequently, the higher fixed costs associated with the design and development of educational resources, may be justified by widening learner cohorts and extending the reuse of the developed resources over time (Bates, 2005; Meyer, Bruwelheide, & Poulin, 2009). Digital resources are, in theory, easier to share and reuse. Therefore they can potentially cut costs. A range of resources, from small, granular resources, such as images or sections of text to larger, online courses have been used and re-used within and across institutions and opened to the public (Littlejohn & Pegler, 2007). Issues of sharing, organising and re-using educational resources globally make up a large part of the discourse on open learning and widening access to education (Downes, 2007; Littlejohn, 2003b; Wiley & Hilton III, 2009). Issues around reuse are complex and multi-faceted, including granularity, sourcing, combination, interoperability and collaborative development of educational resources (Littlejohn, 2003c). Economies of scale are often considered along with economies of scope - increasing the diversity of educational services by using related educational resources. Economies of scale and scope are believed to have the potential to reduce costs while, at the same time, improving quality (Morris, 2008).

Educational Attainment: The Educational Attainment domain brings together issues of effectiveness and of the quality of e-learning. Indicators of quality include student satisfaction, learner support, student attainment and achievement.

Commitment to continuous quality improvement has already been integrated into the strategic practices of many educational institutions. In the UK, the Higher Education Academy's Benchmarking and Pathfinder Programme provided a platform for quality improvement (Mayes, et al., 2009). Many institutions already incorporate constant feedback loops for monitoring student learning outcomes and levels of satisfaction.

Evaluation of strategies to improve educational outcomes is part of this domain. Oliver (2005), referring to research literature which discusses successful e-learning practice, highlights a set of determinants of quality: learning resources, learning design, level of learning flexibility, improvement of learning outcomes and engagement. The process of benchmarking, that is potentially beneficial for scoping studies, involves comparison of local practice with identified examples of excellence or best practice. Oliver (*op. cit.*) suggests that identification of best practices is based on: [a] learning designs, [b] learning resources and [c] delivery processes.

Measures of quality and indicators of successful practices can be discussed on different levels (i.e. macro/meso/micro). The use of Open Educational Resources (OER), referred to earlier as part of the Resource Management domain, can be viewed in the light of quality and design. There are initiatives that focus on quality and innovation through open educational practices. On a meso level, possible business models, institutional cultures, issues of quality and technical implementation can be discussed. Other quality indicators include assessment, student/teacher feedback and quality assurance.

Professional Development and Innovation: The domain of Professional Development and Innovation focuses on the continuous professional improvement of teachers and their innovation or experimentation with new technologies. Teachers are instrumental in ensuring effective use of new educational technologies (Baylor & Ritchie, 2002; Margaryan & Littlejohn, 2008). In the context of sustainable e-learning practice, the acquisition of new skills and the continuous professional development of teaching skills are emphasised as important components of sustainability (Attwell, 2004). Attwell (*op. cit.*) also highlights the key role of collaboration in successful, continuous professional development. Empirical literature around innovation and professional development can, therefore, contribute to this discussion of sustainable e-learning.

Communities of practice (Lave, 1991) are useful mechanisms for the gradual development of expertise and collaborative enhancement of practice. Also, learning networks (C. Jones, Ferreday, & Hodgson, 2008; Thorpe & Kubiak, 2005; Wilson & Stacey, 2004) are often associated with professional development. There is a growing interest in the study of networks within the fields of Education and Learning Sciences (e.g. Dirckinck-Holmfeld, Jones, & Lindström, 2009; Koper, 2009). Networks can provide access to information, encourage experimentation and foster educational innovation. However, Blin and Munro (2007) highlight that teaching practices are seldom subject to transformation and adjustment. The concept of learning networks provides potential for radically new practices within the e-learning domain. Social platforms and web tools enable learners to connect with and tap into groups, networks or collectives. Through social networks, learners actively source, use and contribute to the development of new knowledge (Dron & Anderson, 2007).

Table 1 summarises the discussion outlined in this section, depicting the operational domains with reference to aspects of sustainable e-learning practice gathered from conceptual literature. As previously noted, each of the aspects can be considered on a macro, meso and micro level, of which it is the meso/institutional level that is the focus on this scoping study.

Table 1: Factors of sustainable e-learning practice classified by operational domain and levels

Operational Domains	Factors of Sustainability by Levels		
	<i>Macro/Global</i>	<i>Meso/Institutional</i>	<i>Micro/Programme</i>
Resource Management	Open standards: - OER for development - Financial Viability of OER - Knowledge repositories - Interoperability	Cost-effectiveness: - Economies of scale and scope - Fixed and variable costs - Staff time - Release/Repurpose of resources - Use of OER	Personal Agenda: - Practitioner workload - Availability and reusability of resources - Specialist/Generic resources
Educational Attainment	Quality of resources: - OER - Open educational designs	Quality of learning outcomes: - Student feedback - Teacher feedback - Assessment - Standardisation	Quality and learning outcomes: - Student feedback - Assessment - Employability
Professional Development and Innovation	Professional Networks: - Virtual networks of educational practitioners and researchers - Cross-organisational networks	Cohesive Learning Communities: - Communities of practice - Professional networks - Ad-hoc networks	Teams and Peer-Groups: - Small groups/teams or individual progress

4.1.4 Literature Search Keywords: Identification and Selection

The selection of search keywords to becomes less ambivalent when the three operational domains are applied. However, an expanded list of search terms is necessary for comprehensive scoping. The search keywords used in this scoping study are outlined in Table 2:

Table 2: List of search keywords for each of the operational domains.

Operational Domains	List of Keywords
Resource Management	cost-effective/cost-effectiveness economies of scale economies of scope efficiency/efficient practice staff time/man hours
Educational Attainment	long-term learning benefits longitudinal evaluation achievement/performance effective practice/design usability/ease of use student/teacher attitudes quality assurance
Professional Development and	long-term benefits

Innovation	innovative practice educational change community of practice teachers/practitioners/educators teacher/practitioner/educator networks teacher competence
General/Intersection	sustainable change sustainable innovation sustainable benefits longitudinal evaluation sustainability

4.2 Literature Search Overview

The literature search was conducted using library services provided via electronic databases available at Brunel University of West London. Key sources were accessed and selected using the DialogDataStar library service. Literature that was not available as full text was not considered. When a large number of similar studies were identified, priority was given to more recent works. Google and Google scholar search tools were used in parallel with the library search tools. Key studies referenced within texts were sourced. The initial search used the keywords 'e-learning', 'technology enhanced learning' and 'online learning'. Further refinements using one or more keywords from the list in Table 2, were repeatedly carried out.

4.3 Inclusion and Exclusion Criteria for Searched Literature

The scoping study included following types of literature:

- discussions of issues of sustainable e-learning practice in Higher Education;
- studies of strategies and approaches applied and implemented in universities;
- case studies and empirical research reporting on issues of (un)sustainable e-learning practice;
- empirical studies, published between 2000-2010, that refer to sustainable practice.

Papers focusing on sectors other than HE (eg secondary or primary education or adult workplace learning) were not considered. A large number of papers were excluded since they did not meet the criteria.

A total of 46 studies were reviewed. The full list of papers included in the study is available in Appendix 5 and is summarised and discussed below.

4.4 Charting Collected Data

Papers and articles included in the study were categorised and grouped into emerging themes, following the method outlined by Arksey and O'Malley (2005). Summaries of and key data on each study were fed into the chart. This information included [a] name author and date, [b] method, [c] operational domains and [d] an overview of the paper. The themes are presented in Figure 2.

4.5 Evaluation of Selected Literature

The literature search was guided by the operational domains illustrated in Figure 1. Each paper included in the study was associated with at least one of these operational domains. Despite the fact that many of the articles included in the charting process extended beyond a single domain, no single study was ascribed to more than one domain. For example, some studies focusing on reducing teaching costs also explored quality of teaching. Each study was examined in relation to each of the domains.

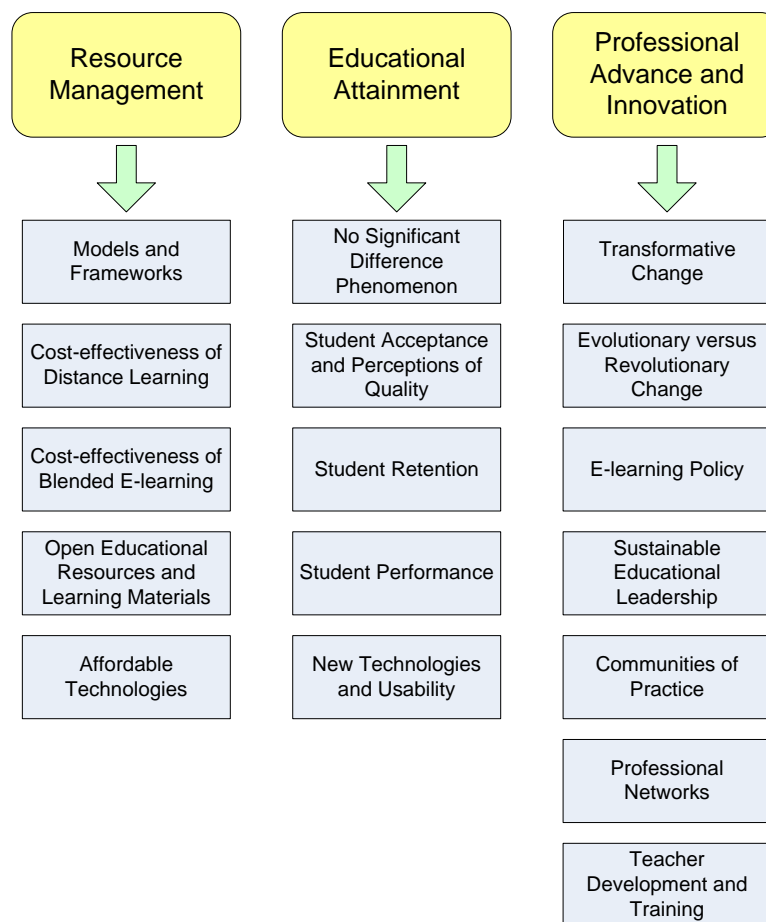


Figure 2: Operational domains with associated themes.

4.5.1 Resource Management

Studies within this section include those categorised under the Resource Management operational domain. They focus on strategies and approaches taken by educational institutions to improve the management of human and financial resources. Resource management issues span the themes of cost-effectiveness, efficiency gains and economies of scale and scope.

A major focus in this domain is management of the cost of e-learning practice. Costing is usually discussed in relation to strategic targets, for example the quality of teaching/learning,

the numbers of students, or technological/pedagogical innovation. A major area of focus has been the mode of e-learning practice and whether learning is fully online (for example, distance learning) or 'blended' (in particular, a combination of face-to-face and online). A wide variety of institutional strategies and approaches have been adopted to control costs.

An underlying assumption is that good quality teaching can only be delivered at high cost. Wellman (2010) challenges this supposition, questioning whether large amounts of funding is necessary for effective practice. In a review of empirical studies, Wellman rejects the widely accepted assumption that money equals quality, while acknowledging a strong correlation between institutional revenue and rankings.

Models and Frameworks. Some recent studies call for higher productivity and cost-effectiveness of HEIs (Ashraf, 2009). Proposed mechanisms for improving cost effectiveness include guidelines for institutional change that incorporate models for improved use of technology. Referring to approaches adopted by the Open University UK (Daniel, 1999), Molenda (2009) suggests a systems theory approach, which rationally divides teaching and learning tasks, resulting in cost-effectiveness. Nicol and Coen (2003) and Laurillard (2007) suggest more complex models to evaluate the benefits and costs of e-learning. While the models developed by Nicol and Coen (*ibid.*) and Laurillard (*ibid.*) differ in focus of learner benefits, each of the models provides a detailed and complex evaluation mechanism. In practical terms, these models can guide institutional planning and development, rather than being used retrospectively to evaluate cost-effectiveness.

Cohen and Nachmias (2006) propose another model that provides a quantitative mechanism to analyse the cost-effectiveness of online instruction. The model utilises web-mining techniques for collecting and analysing access logs and evaluating the use of Virtual Learning Environments (VLE) for teaching and learning. The model can be applied in blended e-learning design, as well as in a fully online educational setting. It takes into account a number of indicators and characteristics that are associated with costs and quality. According to its authors, the model enables examination of return-on-investment and informs instructors and university policymakers of the results. Furthermore, the model has been internally calibrated and technologically implemented to offer a degree of automation (Cohen & Nachmias, 2009). None of these studies can demonstrate that implementation of change models will guarantee cost-effectiveness, since they are often context-bound and limited in universal applicability, due to variations in learning design, approaches and goals.

Cost-effectiveness of Distance Learning. Costing and business plans comprise a sizeable part of the sustainability debate. Earlier studies suggest that cost-effective online teaching methods require careful and informed planning and course design (Ng, 2000; Whalen & Wright, 1999). While considerable attention is given to analysing the costs of information technologies in general, fewer case studies measure and analyse the costs of e-learning systems. An analysis by (A. W. T. Bates, 2005) examined a range of influencing factors including fixed, variable and indirect costs, the number of students, course design and choice of media. In distance learning settings the case studies differ in their approaches to analyses of cost-effective course design. Relevant studies dealing with cost-effectiveness are reviewed in detail below.

A cost-benefit analysis of an online Master of Science in Instructional Systems Technology programme was conducted at Indiana University in the USA (P. Parker, Kapke, Subude, Ludwig, & Van Hoogstraal, 2001; Van Hoogstraal, et al., 2005). The study adopted a model developed for a previous cost-benefit analysis of their online program. They predicted a revenue loss for the university if the programme was offered online and forecast 0% in return-

on-investment for the following five years. The authors presented recommendations based on three scenarios focused on increasing number of enrolled students, of tuition fees or both. Although these scenarios are not underpinned by empirical data, this study may serve as a useful exemplar for calculating the costs and benefits of designing an online course.

A similar approach is proposed by Bates (2005, pp. 153-174), who designed a model for building a business plan for developing, implementing and maintaining online courses. Bates (*op.cit.*) proposes several models for fully online and blended course designs. Another study examined the business side of distance learning programmes (Ramage, 2005). The author evaluates 12 studies for cost-efficiency focusing solely on return-on-investment. The Ramage review suggests that 83% of the considered institutions were not cost-efficient. The more successful institutions recorded a return-on-investment of 15%.

The context in which studies are conducted has a substantial impact on the suggested strategies for obtaining funding and meeting financial constraints. Examples of such differences are discussed in a study on the development of an online programme at Indira Gandhi National Open University in India, comparing it with the challenges of developing online programs in other countries (Perraton & Naidu, 2006). Differences reported include the ratios of government funding and income generation through student fees, as well as the choices of technology tools and media. Similarities include the importance of securing high numbers of students for reducing the fixed costs related to course development. Economies of scale are frequently cited as a strategy for reducing costs of online courses and achieving sustainability. Morris (2008) suggests considering economies of scale in relation to economies of scope but there is a lack of such studies in empirical e-learning literature.

Cost-effectiveness of Blended E-learning. Papers that discuss the costing of blended e-learning emphasise the benefits of integrating information technologies into learning. Distance learning programmes tend to be costed differently from blended learning. To highlight this difference, these papers are categorised separately in this report. While some earlier studies suggest that blended learning courses may be more cost effective than fully online courses (Rumble, 1999), other studies recognise that the integration of online approaches into traditional teaching can increase costs, unless carefully modelled (De Freitas & Oliver, 2005; Laurillard, 2007; Littlejohn & Pegler, 2007). Despite the growing number of models for cost-effective blended learning, they have not been empirically tested. The impact of technology on learning outcomes is difficult to measure and evaluate. A proportion of the available literature attempts to maintain a balance in addressing both the costs and learning outcomes.

Successful use of e-learning in a blended setting is reported by Nicol and Draper (2009). The authors report reduced staff workload, as well as an improvement in learning outcomes. Among the studies that focus on costing issues is the work of Loewenberger and Bull (2003). This study evaluates the cost of computer-based assessment (CBA) at the University of Luton in the UK. It attempts to evaluate the cost-effectiveness and benefits of implementing CBA, but conclusively reports only the self-reported measures of reduced workload. The large majority (70%) of respondents (mainly lecturers and managers) are reported to have noticeable time savings, of which 40% indicated cost savings within two years of implementation. These savings were mainly associated with the use of question banks. The limitations prevent further generalisation, but the authors suggest directions for future research such as the use of longitudinal approaches in measuring the learning benefits associated with CBA. Extension of the studies, to include evaluation of workload for marking essays, is also recommended.

One approach to cost savings, discussed by Lück and Laurence (2005), is the integration of elements of online learning into predominantly face-to-face courses. The authors discuss the

experience of a Canadian University in hosting distinguished guest speakers via videoconferencing. A successful pilot encouraged scheduling regular videoconference lectures by external specialists. The authors report positive student feedback as well as monetary savings. Pedagogical, technological and administrative issues discussed by the authors include: positive student feedback, immediate and substantial savings and, the development of international collaboration.

Other approaches to cost savings focus on cost-effective use of technology tools. For example Vallis and Williamson (2009) discuss cost-savings that can be achieved from considering an alternative to interactive whiteboards. The authors suggest using a regular projector connected to a tablet computer with a wireless pen, suggesting that ten such systems can be introduced for the price of a single interactive whiteboard.

In summary, studies focused on the costs of blended initiatives usually also take into consideration the benefits for learners. In future, the focus of the studies may shift due to current financial constraints. However, the contribution of these studies to the sustainability debate remains limited, since it is difficult to estimate 'hidden' costs within blended learning settings. Therefore reported outcomes may not be generalisable.

Open Educational Resources and Learning Materials. Many studies focus on the balance between costs and quality. Sustainable e-learning may be viewed as a way of reducing staff time for sourcing, repurposing, evaluating and reusing learning materials (Littlejohn & Pegler, 2007). 'Reusing online resources: a sustainable approach to e-learning', edited by Littlejohn (2003b), integrates a number of studies that discuss strategic perspectives and vision on design, development and re/use of educational resources, and examines the concept of Reusable Learning Objects. Learning Objects are commonly perceived as digital learning resources but constitute a much wider concept extending content and information with tools, tests and even methods (Mayes, 2003). Reusable Learning Objects formed the basis of the expanding OER movement and the studies examined by Littlejohn elaborate on the concept of Learning Objects examining their properties and their capacity for inducing pedagogical and administrative benefits. The following section discusses research that investigates the possibilities of RLO for cost reduction.

Focusing on gains from incorporating learning objects, Weller (2004) discusses the potential of reusing these in designing new courses. He reports significant reduction in time required for development of a course. Furthermore, podcasting is suggested as a cost-effective method for creating learning objects, due to the relatively low cost of production and high potential for reuse (Salmon & Edirisingha, 2008). Virtual labs, offered as a substitute to expensive laboratories and equipment, are also believed to reduce teaching costs and improve student access (Campbell, Mosterman, Marcinkiewicz, & Wang, 2004). Outside of the scope of this study, but still informative, is the review of the use of learning resources in the secondary education sector, which reports potential cost savings by simulating learning activities and geographical experiences that would otherwise be expensive or dangerous to integrate in teaching (Schibeci, et al., 2008).

Inspired by the Open Source movement, initiatives that encourage open sharing and reuse of educational resources and of learning objects have attracted considerable attention from educational institutions and policy makers (Baraniuk, 2008). The UK Funding Councils have identified the sustainable use of digital technologies to be critical for the UK in maintaining a position as a global leader in education. They have funded a multi-million pound initiative on OER. The programme is a joint venture involving the UK Joint Information Systems Committees (JISC), Higher Education Funding Council for England (HEFCE) and the UK Higher

Education Academy (HEA)⁴ and comprises various projects. The Open Educational Resources Programme⁵ aims to make a wide range of on-line learning resources freely and easily available, discoverable and reusable, by both educators and learners. The programme aims to release a wide range of new course materials (including complete modules, notes, videos, assessments, tests, simulations, worked examples, software) and other resources and to identify successful and sustainable approaches to resource sharing. A major goal of the programme is achieving sustainable change in educational culture, moving away from the current focus on content ownership towards the creation and reuse of openly shared content. An associated OER InfoKit⁶ initiative aims to inform different stakeholders interested in using and developing OERs. The ultimate goal of the programme is to instigate a change in the way practitioners, learners and support staff think about educational resources (Littlejohn, 2010).

While the sharing and reuse of OERs offer great potential for cost-effective practices, there is little empirical evidence on actual cost-savings (Friesen, 2009; Geser, 2007). Some general conceptual development and experimentation in search of new business models are already underway. For example, models that utilise network infrastructures and integrate the concept of 'produsage', user-led collaborative creation of content (Bruns, 2006), are being proposed as sustainable. Calls for involving students as producers are increasingly being made (Neary & Winn, 2009). The active role of students in developing content can potentially reduce the institutional costs of production and improve its quality. Introduction of student-generated work into content repositories, for instance the MIT OpenCourseWare collection, is already being considered (Kanchanaraksa, Gooding, Klaas, & Yager, 2009). Furthermore, the potential for saving costs by using OER is a persuasive argument for use in developing countries (Thakrar, Wolfenden, & Zinn, 2009).

Affordable Technologies. The affordability of specific e-learning services is another important element in the discussion of sustainability. Heavily relying on the number of enrolled students for funding, universities may consider strategies that reduce the cost per head of student learning.

For example, Klymkowsky (2007) questions the need to use textbooks for a specific introductory course and suggests substituting textbooks with learning resources distributed via institutional Virtual Learning Environments, use of openly available web-based resources and group discussions.

Annand (2008) investigates the use of e-books in relation to more expensive, printed books. He compares students' attitudes towards the medium and looks for variations in student achievement. The results demonstrate that while the use of e-books does not affect knowledge acquisition, printed books are preferred by students. The author proposes that substantial savings may be achieved by universities through substitution of printed teaching materials with electronic resources.

4.5.2 Educational Attainment

The quality of e-learning, and its impact on educational outcomes, is widely discussed in educational literature. Knowledge base in this area expands continuously through the

⁴ Higher Education Academy (HEA) - <http://www.heacademy.ac.uk>

⁵ Open Educational Resources Programme by Joint Information Systems Committees (JISC): <http://www.jisc.ac.uk/oer>

⁶ Open Educational Resources InfoKit: <https://openeducationalresources.pbworks.com>

publication of research papers, policies, and guidelines for quality improvement. The literature comments on a number of effectiveness measures, including student achievement records, retention rates, skill acquisition and personal development. This section provides a brief overview of the studies positioned within the Educational Attainment domain. It looks at long-term benefits, or the lack thereof, in e-learning practice.

Issues of quality and effectiveness of e-learning are topical and widely discussed by educators, institutions and organisations. Organisations such as European Foundation for Quality in eLearning (EFQUEL)⁷ aim to contribute towards improving the quality and dissemination of effective approaches to sustainable e-learning.

Policy makers concerned with effectiveness are calling for evidence-based approaches in designing and implementing e-learning. Initial attempts in achieving effective e-learning practice took a 'one size fits all' approach that resulted in generic strategies and guidelines that were not always relevant. The need to adjust e-learning environments to address diverse student needs and to reflect the growing range of educational institutions and contextual differences is increasingly recognised.

No Significant Difference Phenomenon. The No Significant Difference Phenomenon (NSDP) began with publication of a book of the same name by Russel in (1999). Russel compiled a set of studies on the use of educational technologies that showed no significant effect on learning or performance. Today the NSDP website⁸ continues to collect studies reporting on the effectiveness of distance or blended e-learning. While studies that attempt to evaluate a broad range of e-learning approaches are often criticised (Ramage, 2001), a number of studies attempt to evaluate, on a broad scale, the effects of using technology in education. Salient points from the most relevant studies are presented below.

A meta-analysis⁹ published by Clark (2001), demonstrated significant learning benefits when using information technologies as opposed to traditional ways of learning. However, Clark (*op. cit.*) attributes the reason for the reported benefits to the instructional strategies built into the learning materials and course structure rather than the mode of instruction.

Similar findings were reported in a more recent meta-analysis (Means, Toyama, Murphy, Bakia, & Jones, 2009) conducted for the U.S. Department of Education. It found evidence that students who spent more time studying online gained greater learning advantages than those studying face-to-face. The authors associate this advantage to the students' having greater control of the medium of learning.

A more focused approach is adopted in another meta-analysis conducted by Bernard *et al.* (2004). He considered studies that investigate student achievement, retention and attitudes. The study identified higher achievement records in distance learning when 'asynchronous learning' is employed. 'Synchronous learning' was identified as more favourable for practising face-to-face teaching/learning. However, the study argues that quality of course design is more important than the characteristics of the medium of learning. This claim was reflected in a recent press release from the Open University of the Netherlands (2010). The University have recently achieved a leading position in the National Student Survey that included 14 Dutch

⁷ The European Foundation for Quality in eLearning (EFQUEL) serves as sustainable and proactive network and provides services to the worldwide eLearning community: <http://www.qualityfoundation.org>

⁸ The website designated to the book 'No Significant Difference Phenomenon' provides access to studies included in the book and more recent publications on the topic: <http://nosignificantdifference.wcet.info>

⁹ Meta-analysis is a method for integrating quantitative research findings from individual studies (Wolf, 1986).

universities. Despite offering predominantly online and distance education, the university was ranked above other universities that are based around on-campus mode of teaching.

Thus, the question of whether e-learning leads to positive outcomes has become less relevant. The debate should now shift on how to enhance and maintain effectiveness of e-learning practice to be able to contribute to sustainability of e-learning.

Student and Teacher Acceptance and Perceptions of Quality. Understanding the attitudes of students and teachers towards e-learning is a necessary step for creating appropriate e-learning environments. A number of recent studies have considered this issue and some are discussed below.

A study conducted by Liaw (2008) focused on the negative attitudes of students towards the use of Blackboard, the institutional VLE. The study was based on a questionnaire survey that explored students' satisfaction with and perceived usefulness of the VLE. The results suggest that perceived self-efficacy is a critical factor influencing student satisfaction. Among other factors affecting the e-learning experience were the quality of multimedia instruction and the need for better interactivity and communicative functions.

Another study explored factors influencing the use of e-learning environments by teachers (Mahdizadeh, Biemans, & Mulder, 2008). The study identified the perceived added value of the technology and its ease of use as the predictor of actual use of e-learning tools. Furthermore, teachers' perceived added value of an e-learning tool was strongly influenced by their opinion about computers and the web.

Both of the above studies highlight the importance of perceived usefulness for accepting and using the technology. However, to which extent do these studies inform the sustainability debate? While the studies provide an insight into perceptions of students and teachers, the stronger cultural or social effects, which may have an important impact on perceptions, are not considered here.

A conceptual paper, but relevant in the discussed context, is the paper by Collis and Moonen (2008) that addresses the potential of some emerging technologies. The authors tackled a range of cultural factors associated with the use of Web 2.0 technologies in education, focusing in particular on quality considerations. They analysed the potential benefits and value of new technologies. The authors argued that there were many factors influencing the perception of quality in Higher Education, stemming in part from the diversity of stakeholders involved. The authors suggested that the perception of quality could be inconsistent, especially when emergent technologies such as Web2.0 are involved. They argued that the perception of quality could become a considerable barrier to the adoption and long-term implementation of e-learning practices. The authors emphasised the need for a change of mindset, suggesting that organisational planning and leadership can stimulate this change.

These studies demonstrate that sustainable approaches to quality e-learning may require considerable effort and dedicated work. It is also pertinent to note that long term and consistent studies that move beyond limited perception metrics appear to be lacking from the debate of sustainable quality practices.

Student Retention. The rate of student retention, as opposed to drop-out rate, refers to the measure of students' successful completion of studies within a pre-determined time-period. Student retention has long been considered an important factor of successful educational

practice (R. Jones, 2008). However, compared to traditional settings, student retention rates in open and distance learning have always been lower (A. Parker, 1999). British universities have devoted considerable attention to the issue due to a number of factors including the effect of retention ratings on student choice of institution and funding linked to institutional student retention results (Simpson, 2004). In the UK, high drop-out rates can have a serious impact on the sustainable operation of the institution.

A case study reported by Levy (2007) is focused on student retention in an e-learning setting, investigating factors associated with lower retention rates. The study explored two main constructs: academic locus of control and students' satisfaction with e-learning. Locus of control is considered to be an important element for understanding the nature of learning processes in different situations. This concept is used to specify perceptions about certain outcomes (external locus: if the person thinks he/she has no control). Levy (*op. cit.*) reports that academic locus of control has no impact on a student's decision to leave a course. Student satisfaction with e-learning was identified as a key indicator in a decision to continue a course. Other factors that may affect student retention include restriction to certain compulsory courses and assumptions about the levels of students' academic study, IT or language skills (Beetham, 2009).

The literature also addressed student retention in a blended e-learning setting. According to Boyle *et al.* (2003) the evaluation and further redesign of programming courses, along with changes in distributing resources and collecting assignments online, considerably increased retention rates. The reported increase in the pass rates varied from 12% to 23% depending on the type and level of the course. Unlike the previous study, however, no control was held for the factors that affected the change. The increase in retention was a partial measure of major course redesign, that included development of teaching materials, training sessions for the supporting staff and extensive use of the institutional VLE, rather than simply a measure of the impact of blended e-learning. Additionally, the study compares student feedback collected before redesigning the course with feedback collected after the redesign. The results of the comparison indicate an increase in student motivation and in levels of satisfaction with their personal progress. The paper suggests that improvement of student retention may require consideration of various factors in addition to development of online course components.

Student Performance. When measured in terms of grades and achievements records, student performance becomes easily quantifiable. Hence, many studies referring to successful teaching and learning practices rely on student performance data. From the perspective of sustainable e-learning, student performance is often compared to the costs of providing educational services. There is a commonly held view that financial investment will improve student performance, but there are a number of studies suggesting that e-learning can improve student performance without substantial investments from the university.

Successful use of e-learning in a blended setting is discussed by Nicol and Draper (2009) who reported improvement in learning outcomes despite a reduction of teaching costs and staff workload. The change in pedagogic approaches enabled considerable improvements in student performance across various departments. Focusing on assessment, the authors discussed cases shown to improve learning outcomes and to reduce costs. These improvements included: [a] higher achievement and retention rates from interactive feedback in lectures through use of electronic voting systems; [b] reduced exam failures through integration of regular online formative self-testing; [c] improved quality of written essays and improvement of final grades through the partial replacement of lectures with collaborative essay writing. Such studies could contribute to the development of robust practitioner guidelines on improving learning outcomes and reducing costs, becoming an important element of sustainability research.

New Technologies and Usability. The usability of new technologies is an important factor in their adoption and use. For example, in an educational context, the ease of use of a course website has been identified as one of the key determinants for its use (Selim, 2003).

Lee and co-authors (2009) conducted a similar, but more recent and more broad study than (Selim, 2003). Lee *et al.* investigated the characteristics affecting student enthusiasm, participation and attitude towards e-learning. Perceived ease of use, along with perceived usefulness, teaching materials, design of learning content, playfulness and instructor characteristics, was identified as a factor related to intention to use e-learning systems. However, ease of use, while statistically significant, was shown to have the weakest effect on the intention to use e-learning. Instructor characteristics and teaching materials were the strongest predictors of usefulness as perceived by students and their intentions of using e-learning systems. The study considers student attitudes only and, therefore, teachers' use of educational technology may not be affected by the same factors. However, the identified factors are relevant when considering adoption and continued use of new educational technologies and e-learning services.

Mobile learning is one relatively new area in e-learning that has recently received considerable attention from educational researchers and practitioners. The ubiquity of mobile devices in the West, and the rapid growth of cell phone users in the developing world, opens up a wealth of opportunities for teaching and learning (Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009; Kukulska-Hulme & Traxler, 2005). In the developing world, the affordable cost of accessing the Web and the high availability of cell phones provide sufficient foundation for examination of mobile learning. However, when implementing mobile learning, a number of factors need to be considered, including transitions away from academic environments such as libraries, classrooms or campuses; lack of access to cutting edge technology or ability to use it; and the important work of mentors in encouraging learner engagement (Hall, 2010b). Asia in particular is believed to play a leading role in educational use of mobile devices (Motlik, 2008). The availability of mobile devices generates opportunities for different learning designs, provides expertise on demand, creates extended learning communities and supports life-long learning (Sharples, 2007). Hoppe (2007, p. 32) recommends that mobile learning is "contextualised in broader, integrative educational scenarios". However, the growing number of smart-phones and considerable attention of researchers towards sustainable implementation of mobile learning indicates that research and development in this area is likely to grow.

Pilot studies of use of mobile technologies for educational purposes report generally positive student attitudes. Motiwalla (2007), who developed and evaluated a prototype mobile learning application, suggests that "most learning pedagogies from constructive learning and conversation theories can be adapted for a mobile learning environment" (p. 593). At the same time, he notes that approaches that differ from the traditional use of educational technologies may be needed. He summarises the differences between e-learning and mobile learning techniques stressing the necessity of assessing the granularity of content and highlighting the needs to consider the benefits and drawbacks of mobile technologies when developing supplemental services or substitutes for conventional techniques.

Moving beyond evaluation of perceived benefits, the study conducted by Dyson and colleagues (2009) discussed benefits achieved through use of mobile learning. The authors focused on the benefits of using mobile devices specifically for active and experiential learning. They evaluated the following four aspects: [a] mobile supported fieldwork; [b] stimulation of interactivity in large lectures with mobile technology; [c] use of mobile devices for learning about mobile technology; and [d] use of podcasting. In each case, the economic sustainability and feasibility of the application are considered. The results indicated that each of the evaluated approaches,

except podcasting, supported the process of experiential learning. However, the authors noted that, despite the stimulation of active learning processes, the use of mobile technologies may not automatically guarantee improved learning outcomes.

Although not supported by Dyson's results, podcasting has attracted much interest (Salmon & Edirisingha, 2008). Commonly referring to broadcast distribution of audio files, podcasting provides learners with a level of flexibility. It enables access to lectures at any time and from anywhere. The perceived benefits of using podcasting at an undergraduate level have been studied by Evans (2008). His results indicate that revision of learning materials in the form of podcasts is more efficient than the use of textbooks, and more effective than the use of notes. Although, possibly context-bound, the results of this study can justify further work in exploring the possibilities of acquiring greater efficiencies and effectiveness. Evan (*op. cit.*) concludes that the use of podcasting as a (mobile) learning tool has a significant potential.

Further research into the long-term use and effects of podcasting in various contextual settings may be informative for sustainable e-learning practice. Combining flexibility, relatively low cost of production and potential for reducing the need for travel, podcasting may be beneficial. It is important to emphasise that podcasting, in its simplest form, essentially transfers conventional lecturing to a new medium; replicating traditional pedagogy.

New technologies are not always applied in innovative ways and there is a growing body of evidence that suggests the use of new technologies does not necessarily improve learning or guarantee effective teaching. Crucially, levels of effectiveness may be affected by gaps in practitioners' knowledge on how to use tools to support effective learning (Margaryan & Littlejohn, 2008).

4.5.3 Professional Development and Innovation

Sustainability, as a property of long-lasting successful practice, cannot persist without commitment to continuous progress and efforts to adapt to the requirements of the ever-changing environment. However effective the practice may be, continuous improvement is necessary to maintain its benefits. The rapid and continuous evolution of information technologies puts additional strain on e-learning practitioners and researchers aiming to improve the educational experiences of learners. While teachers and learning technologists may be driving the improvement and maintenance of e-learning services, the process may be affected (both negatively and positively) by various factors such as institutional policies, administrative constraints and the need for training. This section provides a brief account of identified empirical studies that looked at the role of educational leadership, policies and professional development.

Transformative Change. A major initiative within the USA has been the Pew Program on Course Redesign¹⁰ which aimed to drive cost-effective redesign of technology-enhanced courses and programmes. The Pew programme funded the redesign of courses with large numbers of students at ten universities across the USA. The programme established design principles to reduce costs and improve learning. A major outcome was a series of transformative designs, many of which were successful in achieving cost-effectiveness (Molenda, 2009; Twigg, 2003a, 2003b). As a result, the Pew Programme developed five distinct design models: supplemental, replacement, emporium, fully online, and buffet. The models represent a continuum of teaching and learning practice, from fully face-to-face to fully online. The design strategies stress the importance of the collective commitment of teachers

¹⁰ The Program in Course Redesign (PCR) was conducted by the National Center for Academic Transformation and funded by Pew Charitable Trust. <http://www.thencat.org/PCR.htm>

and the affordances of information technologies (Twigg, 2003a). This approach, however, was later criticised by Mayes (2009) who highlighted that these redesigns achieved savings in faculty time and costs by employing graduate and teaching assistants. Mayes' central argument is that transformation is a cultural issue, therefore, evaluation of cost-effectiveness requires shifting from a reliance on hard quantitative data towards a more qualitative understanding of quality issues.

A number of other authors highlight culture change as an important factor in achieving sustainability (Gunn, 2010). For example, through qualitative analysis, Gunn (*ibid.*) identified a range of common challenges facing sustainable e-learning, including a range of cultural issues. She interviewed 30 employees from six universities in New Zealand who worked in administrative, academic and support roles. Gunn (*ibid.*) suggests that sustainability requires supportive organisational structures, a collectively shared vision and accountability of staff. These results, alongside other studies summarised in this section, highlight the challenges of transformative actions and report some practical examples where transforming e-learning practice can contribute to higher sustainability.

Evolutionary versus Revolutionary Change. Higher Education institutions are often viewed as inherently inert organisations and they are known for their slow adjustment to social need. Some academics have questioned whether universities should undergo radical changes to meet pressing societal needs, or whether gradual adjustment is more suitable. Tushman and O'Reilly (2006) argue that successful organisations need to master a skill for spotting the time and need for radical changes. Revolutionary changes are often driven by performance crises, competitive shifts, regulatory actions, or by technological innovations. This contrasts with evolutionary changes that happen gradually. The authors suggest that, in today's rapidly changing environment, organisations "evolve through period of incremental adaptation punctuated by discontinuities" (p. 22). The implication is that organisations that respond to discontinuities by making only incremental change are unlikely to succeed.

Tushman and O'Reilly's work relates to organisations in general, but other authors have looked specifically at organisational change in HEIs. Highlighting the impact of the recent technological advances in education and looking at future trends, Conole (2010) discusses the impact of policy perspectives on e-learning practice. She argues that the management of technological change does not reflect the speed of technological progress. She further stresses that change in educational institutions is hindered by delayed impact on policy and, subsequently, practice. Acknowledging the importance of policy in general, Conole (*op. cit.*) argues that the task of linking e-learning policy to practice is not trivial. She proposes a framework that captures the inter-relation between the involved concepts. The framework views successful implementation of new technologies in e-learning as an amalgamation of policy, research, teaching practice and learner experience. She argues that effective technological intervention can only be achieved by considering all of the factors together.

E-learning Policy. E-learning policy in Higher Education is considered to have an important role in driving change in educational institutions (De Freitas & Oliver, 2005). E-learning, existing within a realm of on-going change, requires strategic approaches and institutional policies. One critical aspect of policy making is the evaluation of e-learning practice. In order to successfully manage change, it is important to be aware of the relative effectiveness of different practices. Attwell (2004) suggests that there is a lack of evidence-based policy towards sustainable e-learning. The work conducted by De Freitas and Oliver (*op. cit.*) provides an informative account of evaluation approaches that may be adopted in Higher Education institutions. Referring to models of organisational change, the authors broadly evaluate organisational changes observed on various levels in a large university. They highlight two common approaches to institutional change (top-down and bottom-up) and argue that best practice

should combine both approaches. Discussing alternative approaches to e-learning policies, the authors argue that evolutionary or discursive models may be insightful for developing institutional policies and structuring change. Other authors disagree, questioning whether evolutionary/discursive change can sufficiently reflect the speed of societal, technological or industrial change (Christensen, Johnson, & Horn, 2008).

Sustainable Educational Leadership. The successful practice of e-learning on an institutional level cannot be implemented and sustained without strong leadership. Considering the fact that institutional change, such as adoption of educational technologies, is often constrained by resistance, the role of leadership in orchestrating change becomes increasingly important (Garrison & Akyol, 2009). This is particularly important if e-learning practices are expected to bring about qualitative changes in teaching and learning.

A study, conducted by Sharpe and her colleagues (2006), described a successful case of introducing an e-learning platform and promoting its use throughout a university. The study reports a considerable increase in adoption and use of the new VLE and credits institutional leadership for driving the change. Among the strategies adopted by the university were appointing e-learning champions; school-level strategies; and targeted staff development. As a result, the number of students using the system increased from 3000 to 12000 and course-presence on the institutional VLE almost doubled during the same, two-year period. The authors attribute the dramatic change to the leadership strategies adopted by the university. The appointment of e-learning champions was assessed to be highly important, as these were individuals who were willing to drive the change and who also worked to engage others. As a result of a coordinated approach, according to the authors, the institution not only achieved considerable uptake in the use of e-learning, but also moved towards more sustainable practice. Whether these strategies, and the subsequent results, can be replicated throughout the sector is unclear. However, this study exemplifies the contribution that educational leadership may have in improving sustainable practice.

The role of institutional leadership in introducing innovative educational practices was also discussed by Sloep *et al.* (2006). The authors presented two case studies that evaluate the implementation of the educational modelling language (EML) in two universities: one purely distance, and the other, a campus-based institution. Unlike the earlier discussed initiative (Sharpe, et al., 2006) these two cases were less successful in establishing an institution-wide adoption of the advocated innovative practice. However, the study offers a valuable insight by signposting possible caveats in introducing innovative educational practices. The authors refer to Diffusion-Innovation Theory (DIT) to explain the failure in adopting the innovative practice that was being introduced. Analysing the practice against the five factors of DIT, the authors suggest that communicating clear implementation goals and being transparent with the users when piloting innovative approaches is important. The authors suggested that, when planning institution-wide initiatives, the factors of DIT must be considered, especially when the initiative is management-driven and the potential users are adequately motivated.

Educational change can be driven by short-term targets and quick political wins, but to achieve change in sustainable education necessitates a more rounded view (Hargreaves, 2007). Taking an ecological perspective, Hargreaves advocates the need for sustainable educational leadership that “preserves and develops deep learning, that spreads and lasts, for all” (p. 224). Sustainable leadership is positioned in his work widely as the preservation, protection and promotion of the fundamental moral purpose of deep, broad and lifelong learning. This form of leadership encourages cohesive diversity, develops material and human resources, and supports the synergy of related organisational structures. However, Hargreaves (*ibid.*) highlights that leadership and transformation is likely to face challenges and advocates the importance of learning from historical and institutional experiences of change.

In the context of e-learning, Garrison and Akyol (2009) argue that educational institutions need to reconsider their teaching and learning techniques. The authors argue that individual charismatic leadership is not sufficient. They support a collaborative leadership that includes cooperation among the leaders at various levels, but which is driven by clear direction, sustained commitment, and rewards from senior leaders. They support the idea of 'generative leadership' (Ritzenhein, Klimek, & Sullivan, 2008) that allows "leaders and students to build solutions in safe, rich and active environments" (p. 26). As the authors eloquently put it: *"Educational leaders must move beyond issues of access and recognise the importance of building and sustaining educational communities of inquiry where students are given the control and assume responsibility to construct and confirm meaning collaboratively. It is these ideas of generative leadership and collaborative commitment that will shape the successful use of instructional technology"* (Garrison & Akyol, 2009, p. 27).

Communities of Practice. Communities of practice (Lave, 1991) have been integral to discussion on professional growth and instructional transformation. Wenger (2009) loosely defines communities of practice as groups of people who share an interest, craft or a profession, or who have common interests in a field. He considers communities of practice an integral part of people's daily lives – informal and lacking explicit focus due to their pervasive nature - but encompassing and reflecting human learning. It would appear that teachers, expected to acquire new skills and enrich their e-learning experience, may benefit from joining or developing communities of practice. However, this can be challenging.

There is a growing body of knowledge that discusses the strategies for developing and sustaining communities of practice in educational settings. A vivid example is the recent book "Communities of practice: creating learning environments for educators" edited by Kimble and colleagues (2008). This work contains a collection of papers that discuss the benefits provided by communities of practice. It also includes works that highlight the challenges of building and sustaining communities.

Russell (2009) turns to complexity theory to demonstrate how institution-wide exchange of ideas across disciplines can increase the diversity of options available to teachers introducing innovative e-learning practices. However, he and others (Attwell, 2004) find that individual training for teachers is not sufficient to drive the necessary change. Among the challenges presented by teacher training are misalignment of professional programmes from pedagogic and technical innovation; lack of opportunities to practice skills acquired after training; and limited support.

Professional Networks. Professional networks, which exhibit a less cohesive structure or have a different power dynamic compared to communities of practice, can induce a qualitatively different form of professional development.

The concept of networks has been attracting educational researchers' attention for some time (J. Brown & Duguid, 2001; Dirckinck-Holmfeld, et al., 2009; Goodyear, 2004; Steeples & Jones, 2002). Current social media not only allow elements of connectivist learning to be incorporated (Siemens, 2006), but also serve as considerable repositories of network data that can be used for evaluating and understanding the structure and dynamics of learner networks. Social network analysis (SNA) is one of the techniques increasingly applied to study the structure, patterns and prominent tendencies within networks (Haythornthwaite, 2005; Reffay & Chanier, 2003). SNA allows analysis of human interactions and relationships between individuals, groups and communities (Wasserman & Faust, 1994; B. Wellman & Berkowitz, 1997). It

provides a number of benefits for studying online engagement and participation. The number of empirical studies that employ SNA is growing. It can be employed to study participant interaction, such as email or discussion board communication, and learner access records, such as educational systems and materials (Park, 2003), as well as to analyse group and community development (P. R. Monge & Contractor, 2003). Klamka (2010) describes three case studies that use SNA within an e-learning context and highlights some of the potential benefits to analysing and understanding networks. He discusses the European funded PROLEARN network and a case study of online communities of research professionals working in the area of Computer Science. The initial success, coupled with the substantial attention to analysing teaching and learning practices by researchers, demonstrates the potential of this area for informing the sustainability debate. However, more studies are necessary for understanding the sustainability of professional development or innovation networks

The ubiquity of social platforms and readily available tools for networking encouraged the exploratory study conducted by Brouns and colleagues (In Press). The study investigated the perceptions of academic staff towards the use of social network platforms for learning and professional development. The results suggest that social network platforms are predominately used for personal and communication purposes. There is some evidence that these platforms can be used for learning purposes in Higher Education (provided measures are introduced to ensure and encourage interaction, information sharing and exchange), but there are only a limited number of empirical studies that report actual benefits of social network platforms for professional development. Some work towards addressing this gap and aimed at proposing conceptual models for extending empirical evidence is already taking place (Sie, Bitter-Rijkema, & Sloep, 2010).

Teacher Development and Training. Despite the limitations of formal training programmes, faculty development has been identified as one of the factors that contributes to successful and sustainable applications of e-learning (Rovai & Downey, 2009). Attwell (2004) proposes a broad framework to enhance professional development programmes. However, there are few studies that indicate the long-term benefits of developmental programmes and functioning communities of practice.

Lefoe *et al.* (2009) report the need for comprehensive faculty development and support programmes and offer a set of strategies that include developing shared understanding of philosophies and technological affordances; encouraging active practice; continuous reflection; and development of shared vocabularies. A design-based intervention study, conducted by Margaryan (2008), conceptualises and tests in practice a three-component approach for supporting teachers' work-based learning and professional development in relation to implementation of innovative e-learning practices. The use of formal learning approaches, such as targeted workshops and seminars, has also been discussed in the literature and widely used in practice for many years, yet the effectiveness of these approaches has been questioned (Margaryan, 2008; Stes, Min-Leliveld, Gijbels, & Van Petegem, 2010).

Donald *et al.* (Donald, Blake, Girault, Datt, & Ramsay, 2009) focus on offering a mechanism for supporting teachers and learning designers in reflecting on their practice. The strategy of this approach is to articulate the underpinning beliefs of teachers, which can then either be defended or changed. This results in the development or reuse of certain learning designs in specific contexts. The framework includes a questionnaire and visualisation tools that encourage teachers to reflect upon their own understanding, supplemented by a collaborative element of collegial support or critique. The initial results indicate potential gains in developing, repurposing or evaluating learning designs. Even at this early stage, the authors highlight how the differences between teachers and teaching contexts can contribute towards improvement of teaching practices.

Despite the increasing number of studies that investigate the impact of faculty development programmes within HEIs, a recent systematic review (Stes, et al., 2010) concludes that long-term effects of institutional programmes require further research and standardised measures for evaluations. Further development of our understanding of professional networks and communities, their role in innovation and development would considerably improve our views on and approaches to sustainable e-learning.

5 Discussion and Conclusion

This scoping study questioned whether e-learning research could provide definitive answers to the challenges that universities are currently facing. A significant conclusion is that the current state of sustainable e-learning research is too narrow to that explain the complex interrelations across the variables of sustainability. E-learning practice is highly contextualised, therefore it is impractical to seek unequivocal guidance for sustainable practice. This limitation is exacerbated by an over-reliance on smallscale studies to provide evidence for change. While its clear that many smallscale studies have good methodological design and offer practical advice within specific contexts, the level to which the results can be generalised is unclear. Some fields of research aim to span multiple domains, for example studies of cost and benefits. However, few studies adopt a broader perspective or consider a more diverse and encompassing set of factors associated with sustainable e-learning. Most studies tend to over-simplify the learning environment, focusing on a single factor and disregarding potential interplay with other variables (see Appendix 5).

We have drawn a number of broad observations from the literature:

First, educational research should contribute to societal wellbeing (Biesta, 2009). Therefore, research should be grounded within current social, political and philosophical changes.. Reeves *et al.* (2005) call for 'socially responsible' research, through which researchers position research in relation to society as a whole. However, much of the *research into the sustainability of e-learning practice is not framed within fundamental societal issues related to education*. When sustainability is considered in an excessively narrow form, for example by examining financial viability without consideration of wider issues, contributions to the wider debate of public good may be limited or even distorted. This imbalance constrains the evaluation and questioning of educational practices.

Second, cultural and societal changes are challenging traditional educational practices. Institutions are already having to adapt to ongoing change; harnessing the power of technology is an important step (Collins & Halverson, 2010). Thus, sustainable e-learning cannot be explored without consideration of the rapid and continual development of digital technologies. Technological affordances open up new, ubiquitous opportunities for people to learn in a number of ways using a variety of approaches. However, *the knowledge base to support effective implementation is dispersed across a number of domains*. The integration of key, relevant research elements into a coherent body may lead to more effective adaptation within institutions.

Third, two streams of research – sustainability of education and education for sustainability – are developing independently. E-learning practice could be considered as part of a larger system, providing potential for alignment with the nascent work on resilient education (Hall, 2010a; Hopkins, 2009). However, *consideration of sustainable e-learning practice is not aligned with that of environmental sustainability*.

Fourth, *few studies combine and synthesise empirical work*. The methodological affordances provided by meta-analysis or systematic reviews shed light on some aspects of educational attainment. However, few studies employ these methods, leading to a large number of disconnected, context-bound and less generalisable findings. There is a shortage of long-term studies that explore key factors long enough to distinguish long-term and short-term benefits. The limitation in long-term studies may be limited due to the rapid change in use of specific technologies. Studies tend to overly rely on questionnaires data when analysing technology adoption. These studies may overlook changes in mindset or culture (Collis & Moonen, 2008). A recommendation is to have long-term research studies.

Fifth, *few studies examine the tensions between the concepts of cost-efficiency, effective pedagogy, and continuous innovative practice*. There are a limited number of studies on strategic approaches that reduce costs and improve the effectiveness of teaching. However, more research is needed to investigate the trade-offs. There are noticeable differences in the priorities (e.g. costs vs effectiveness) or preferences (e.g. teacher training vs opportunities to network) of empirical studies. Improved understanding of these tensions aligned with multiple stakeholder perspectives could provide practical guidelines on e-learning sustainability.

Sixth, *there are several promising, yet under-researched, areas related to sustainable business models for e-learning*. The impact of networks and collectives (Dron & Anderson, 2007) and an improved understanding of the effects of networks can provide insight into sustainable forms of e-learning. Similarly Open Educational Resources offer opportunities for moving beyond the traditional economic models. Mobile learning has not yet fully impacted upon formal learning.

Finally, the review identified a number of significant gaps in the literature. Within the Resource Management domain gaps include: [a] meta-analysis of e-learning costs (these have been restricted due to lack of available data); [b] empirical research on economies of scope; [c] long-term longitudinal analysis on the effects of reducing costs; [d] empirical research on cost-effectiveness of OER. The Educational Attainment domain would benefit from further research in: [e] student/teacher mindset towards e-learning and its change; [f] improvement of learning outcomes and retention rates without substantial increases in costs; [g] benefits of employing new technologies such as mobile devices or podcasting. Professional Development and Innovation would benefit from: [h] long-term analysis of leadership impact on change; and [i] long-term analysis of faculty-development on change.

Improving our understanding of sustainable e-learning is of practical value. Development of a coherent body of knowledge can inform institutional decision making and policy decisions. Empirical evidence that can be generalised and applied more widely across the sector could help address major financial and institutional challenges. It is important to find a means of guiding research on sustainable e-learning. A framework for evaluating sustainability could elevating empirical research to a level where a greater number of factors of sustainable e-learning could be considered and analysed. The framework could encompass a more carefully crafted definition of sustainable e-learning, increasing the integrity of future research. Given clearer conceptual foundations and guidelines, the number of comprehensive empirical studies, can presumably increase, leading to a deeper understanding of the factors of sustainability and, most importantly, their inter-relationship. In the current age of austerity and change a reliable and usable evidence base is becoming increasingly critical.

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Appendices

Appendix 1: Background to the Study

This scoping study was conducted between April and October 2010 as part of a UK Higher Education Academy (HEA) **S**upporting **S**ustainable **e**Learning **F**orum **S**pecial Interest **G**roup (SSeLF SIG)¹¹. Funded by the HEA and led by the Caledonian Academy¹² at Glasgow Caledonian University¹³, SSeLF SIG provides a platform for exploration and debate in addressing the issues of sustainable e-learning practice.

SSeLF was established in 2003 for the UK Technology-Enhanced Learning (TEL) community to debate ideas arising from research in learning and in particular TEL and their application in teaching. SSeLF comprises academics, researchers and educational developers within the UK HE and FE communities seeking to research and develop innovative directions of research and forms of practice. Since its foundation in 2003, SSeLF has explored a range of key themes, including social dimensions of TEL, blended learning, learning design and implementation, work-related learning, economies of scale, cost-efficiency, quality enhancement, and barriers to technology adoption in teaching and learning. Key contributors to the Forum have included scholars, practitioners and thought leaders in TEL from a range of countries including the Netherlands, New Zealand, Belgium, Canada the US and the UK.

In December 2010 the SIG was renamed Technology Enhanced Professional Learning to more accurately reflect the central interests of the group members as well as the central remit of the UK Higher Education Academy.

¹¹ SSeLF SIG community website: <http://uk-sself.ning.com>

¹² Official website: Caledonian Academy <http://www.academy.gcal.ac.uk>

¹³ Official website: Glasgow Caledonian University <http://www.gcu.ac.uk>

Appendix 2: Methodological Background

What is a scoping review?

When aiming to explore the concept of sustainability, a scoping review as a methodological underpinning appears to be particularly relevant. The description of scoping studies given by Davis and colleagues (2009) says:

“[Scoping Studies] characteristically involve the development, assimilation and synthesis of broad base of evidence derived from a diverse range of research and non-research sources. They are generally multidisciplinary in nature and commonly supplement existing evidence with the consultative, consensus-building methodologies to gain the benefit of expert opinion and other explicit value judgements such as those expressed by public consensus and preferences.” (K. Davis, et al., 2009)

A scoping review allows synthesis and mapping of broad empirical knowledge base into a single arrangement. This review considers both peer-reviewed and non-peer reviewed sources, and is supplemented with a list of potentially useful information resources that relate to sustainable e-learning (see Appendix 4).

Scoping studies can be improved by including contributions from stakeholders or other researchers. Referred to here as consultation elements, the external contributions can include suggestions for consideration of additional references. These suggestions can be used for either informing or corroborating the study (Arksey & O'Malley, 2005). Likewise, Duncan and Harrop (2006) argue that the quality of scoping review can be improved when “...involving users in scoping research and defining the questions it addresses, as well as involving them as research subjects”. A consultation element will be employed within this study.

How should a scoping review be conducted?

A successful scoping study should be able to withstand the requirements of having clear and consistent methodological design. In the words of Davis and her colleagues (2009, p. 1398) “*Optimal scoping study is one that demonstrates procedural and methodological rigour in its application*”. Nevertheless, they observed a range of methodological differences, when reviewing the scoping studies conducted in the public health area. Based on the observed differences a conceptual hierarchy was introduced that categorises scoping studies from low level (elementary, descriptive) to high level (substantial, conceptual). The high level studies, resembling systematic reviews in their methodological stand, constitute a critical appraisal of a diverse body of knowledge and provide a ‘panoramic’ view of the current knowledge (K. Davis, et al., 2009).

What is the difference between scoping reviews and other forms of synthesis?

Scoping studies differ from systematic reviews or meta-analysis (Arksey & O'Malley, 2005; Poth & Ross, 2009). Unlike meta-analysis, scoping reviews define inclusion/exclusion criteria on relevance rather than quality of research. Furthermore, scoping studies allow inclusion of exploratory studies and may accommodate consultation elements that are not typically

considered in either systematic reviews or meta-analysis. Despite the fact that a critical appraisal of the quality of the included studies is usually avoided, conducting scoping studies requires an analytical approach for describing large number of studies. Therefore, scoping studies should not be viewed as a 'quick' and 'easy' method of performing literature review (Arksey & O'Malley, 2005). Rigorous, procedural and transparent methods are needed for gaining value from the pursued mapping of the existing research (K. Davis, et al., 2009).

Appendix 3: Investigation into the Concept of Sustainability

The Origins and the Use of the Term Sustainability

A clear and succinct definition for the term sustainability is necessary (B. Brown, et al., 1987). Shearman (1990), however, suggests moving beyond defining sustainability, by discussing the factors required to instantiate sustainability. Shearman suggests thinking about sustainability through the lens of key questions such as: why is sustainability desirable, what form of sustainability is best, or how should sustainability be pursued? To achieve such a definition, an inquiry into the concept of sustainability is necessary.

What are the lexical definitions of the term sustainability?

The word 'sustainable *adj.*' is defined by dictionary references as: "*able to be maintained at a certain rate or level*", *The Oxford Dictionary of English* (Soanes & Stevenson, 2005); or "*able to be sustained or upheld*", *The New Oxford American Dictionary* (Ed. McKean, 2005). More generally, the verb 'sustain' is defined by *The Oxford Dictionary of English (op. cit.)* as: "*cause to continue for an extended period*" or "*uphold, affirm, or confirm the justice or validity*". In an ecological context the term 'sustainability' indicates the process of "*conserving an ecological balance by avoiding depletion of natural resources*" (*ibid.*). Regardless of the variations in defining the term, there appears to be a common foundation, which infers the necessity of continuity over time.

What are the etymological definitions of the term sustainability?

Beyond the lexical meaning, the concept of sustainability, as it stems from the academic literature, is frequently associated with the mandate adopted by the International Union for Conservation of Nature (IUCN) in 1969 and the United Nations Conference on the Human Environment in Stockholm in 1972 (Adams, 2006). Since then, sustainability has been discussed in a variety of contexts and from a range of perspectives. The notion of sustainability has penetrated political, economic and social agendas and is playing a major part in shaping the discourse on sustainable society, economy, energy, agriculture and resource use (B. Brown, et al., 1987). Without explicitly defining the notion of sustainability, it is often described as the "*goals or endpoints of a process called 'sustainable development'*" (Diesendorf, 2000, p. 22). The much-cited Brundtland report (1987, p. 43) defines 'sustainable development' as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". This definition captures the complexity of the term by integrating a set of dimensions into a single concept. Sloep (1994) notes that the concept of sustainability, unifying a set of areas, was environmental sciences' ticket to becoming a genuine inter-disciplinary field.

How can environmental literature inform the sustainable e-learning research?

Environmental science literature can provide an insight into the concept of sustainability. The origins of the concept can inform the process of deriving a working definition of sustainable e-learning and aligning it with the educational discourse. The rationale for reviewing the environmental literature is to understand the origin and the development of the term. The analogies between educational and ecological systems, and the growing interest towards

studies of educational phenomena in their complexity of interrelated factors further justify this line of inquiry (B. Davis & Sumara, 2006, p. 126; Mason, 2008).

What are the dominant definitions of sustainability environmental literature?

The environmental literature on sustainable development contains prominent positions mapped and discussed by Lélé (1991). He referred to ecological sustainability, as an attribute of human activities, to be the goal of a developmental process. He highlights that the foci and priorities of development objectives in a rapidly changing world are likely to change and evolve.

Sustainability, however, remains a fundamental concern regardless of changes in development objectives. Discussing the social, ecological and developmental connotations, Lélé (*ibid.*) indicates a possibility of tradeoffs between the ecological sustainability and objectives. At the same time, however, he stresses the possibility of mutual reinforcement between the two. Later works extend this discussion by considering ecological sustainability from an alternative perspective.

The interplay between various attributes of sustainability becomes clearer when viewed as part of three interlocking dimensions: economic, environmental and social (see Figure 3). The essence of today's mainstream sustainability thinking is perceived as an interchange of these dimensions, known as the 'three pillars' of sustainability (Adams, 2006). The main conception of sustainability, applicable locally and globally, is based around the integration of these pillars into a unified system. Therefore instantiation of sustainability will be a long-term or a perpetual process (Kemp, Parto, & Gibson, 2005).



Figure 3: The three pillars of sustainability (Adams, 2006).

Sustainability can only be instantiated by taking into consideration an adequate context. Understanding local factors can encourage appreciation of wider sustainability issues. According to Kemp et al (2005, p. 15): 'Sustainability is about locally suited options that are globally sustainable'. Therefore sustainability should be instantiated as a multi-level, multi-player and multi-dimensional concept (Kemp, et al., 2005). We cannot underestimate the potential for conflict between local and global issues, as well as disagreements amongst the representative stakeholders at these different levels.

Sustainability in Educational Context

What are the definitions of the term sustainability in educational literature?

The definition of the term sustainability varies widely, and in much of the published work is not made explicit. Hence, the discourse on sustainable e-learning is largely equivocal. The studies

usually cover a number of factors and elaborate the role of these factors in enhancing long-term benefits and continuation of e-learning practice (P. Arneberg, et al., 2007; A. W. T. Bates, 2005; Littlejohn, 2003c). Variations of scale are also apparent, as studies discuss the issues and implications of sustainability on macro/global (Downes, 2007), meso/institutional (Hope & Guiton, 2005) and micro/project levels (Grossmann, Weibela, & Fislerb, 2008). However, can any of these approaches be used to frame this review? To answer this question, a further inquiry is conducted to evaluate the available approaches and stands.

A widely used definition of sustainability, first outlined in Brundtland's report has been adopted within educational contexts. One example is, Robertson's (2008, p. 819) study which defines sustainable e-learning as "e-learning that has become normative in meeting the needs of the present and future". Environmental approaches are adopted in the emerging work on resilient education. The concept of resilience denotes current abilities to adapt to future challenges (Hall, 2010a).

What are the connotations of the term sustainability?

Most definitions of sustainable e-learning refer to costs and benefits, which is sometimes explicated as 'financial sustainability'. Despite sharing a common theme, these definitions vary in their foci. One definition, by the National Committee of Inquiry into Higher Education, quoted by Littlejohn (2003c, p. 91), emphasises the balance between the costs of employing technology and added value, defining sustainable e-learning as "the adoption of technology to maintain teaching quality at reduced unit costs". Other definitions include the continuity of the advantageous positions defining sustainability as "the continuation of benefits after project funding has ceased" (Joyes & Banks, 2009); or similarly as "programmes being offered on a continuous basis and not phased out after a defined project period or after specific subsidies are terminated" (P Arneberg, et al., 2007, p. 6). Some definitions place emphasis on policy. For example Meyer (2006, p. 1) defines sustainability as "policies and practices that improve the likelihood that an online educational program will be financially viable".

Some studies highlight impact and educational quality as an important element of sustainability. For example, Bates' study (2005) examines organisational factors that lead to sustained benefits of e-learning. Such benefits include fostering an institutional culture geared towards continuous improvement and adopting a positive attitude towards personal development. This approach is also adopted by Hope and her colleagues (2005). Rather than focusing on sustainable practice, they emphasise the importance of continuous improvement in the quality and effectiveness of learning approaches. This is a useful perspective, since the integration of e-learning practice itself is often justified by aiming to improve teaching and learning practice. Hope and her colleagues (ibid.) emphasise the importance of sustainable and innovative practice through commitment to systematic feedback from all the stakeholders involved. In other words, it is important not to view sustainability simply as 'sustained practice', but to think about it as a form of continuous enhancement of learning approaches.

Appendix 4: Websites and Other Resources of Interest

1.	SSeLF - Supporting Sustainable eLearning Forum http://uk-sself.ning.com/
2.	HEA: e-Learning Benchmarking and Pathfinder Programme- 2005 - 2008 http://www.heacademy.ac.uk/resources/detail/ourwork/learningandtech/Benchmarking_and_Pathfinder_glossy
3.	Education for Sustainable Development Resources http://staffcentral.brighton.ac.uk/clt/ESD/index.html
4.	COASTAL: (Curriculum, Outcomes, And Sustainable Teaching, Assessment, Learning) Sustainable Development in HE http://escalate.ac.uk/3937
5.	Tony Bates: Struggling with the Costs of Teaching in Higher Education http://www.tonybates.ca/2010/04/24/struggling-with-the-costs-of-teaching-in-higher-education/
6.	Tony Bates: Where Do the Resources for Technology-Based Teaching Come From? http://www.tonybates.ca/2010/05/02/where-do-the-resources-for-technology-based-teaching-come-from/
7.	EvidenceNet: Open-Access Service to Evidence-Informed Practice in Learning and Teaching in Higher Education. http://www.heacademy.ac.uk/evidencenet
8.	HLWIKI: Introduction to Scoping Studies http://hlwiki.slais.ubc.ca/index.php/Scoping_studies
9.	Embodied Education: Reflections on Sustainable Education http://www.futuresevocative.com/Articles/Marcus/embodied-education-reflections-on-sustainable-education.html
10.	OER and sustainability (The Leeds Manifesto) http://cloudworks.ac.uk/cloud/view/3676
11.	Open Educational Resources InfoKit – Sustainability https://openeducationalresources.pbworks.com/Sustainability
12.	Sustainable policies, sustainable resources and publications for sustainable re-use: lessons from OOER http://cloudworks.ac.uk/index.php/cloud/view/3668
13.	Sustainable E-Learning Practices (Video) http://www.youtube.com/watch?v=v13J0p6tzUU
14.	Sustainable E-Learning and Activity Theory (Video) http://www.youtube.com/watch?v=Klca7DL0BF4
15.	JISC Project: Repositories and Preservation http://www.jisc.ac.uk/whatwedo/programmes/reppres.aspx
16.	E-learning tech that is fit for purpose, innovative and sustainable http://zope.cetis.ac.uk/content2/20050731181026
17.	The Open Educational Quality Initiative http://132.252.53.70/
18.	Program in Course Redesign (PCR) http://www.thencat.org/PCR.htm
19.	The Cape Town Open Education Declaration http://www.capetowndeclaration.org/
20.	Quality in E-Learning: The European Foundation for Quality in eLearning (EFQUEL) http://www.qualityfoundation.org/index.php?option=com_content&view=section&layout=blog&id=12&Itemid=66&lang=en
21.	JISC: Learner Experiences of E-learning – List of Projects https://mw.brookes.ac.uk/display/JISCle2/Projects
22.	Sustainable Podcasting: Presentation by Ross Gardler http://www.slideshare.net/rgardler/sustainable-podcasting

Appendix 5: Summary of the studies reviewed in the report

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
1.	Instructional Technology Must Contribute to Productivity	Molenda (2009)	Case Studies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Instructional technology, Productivity, Efficiency, Effectiveness	Models and Frameworks
2.	Scottish Funding Council E-Learning Transformation Programme Project Completion Report.	Nicol, D, S Draper and L Creanor (2007)	Project Report	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cost-Benefit Analysis, Cost-Effectiveness	-
3.	Modelling benefits-oriented costs for technology enhanced learning	Laurillard, D (2007)	Mixed Methods Research	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost-benefit analysis, Cost modelling, Benefits-oriented cost model, E-learning, ICT in education, Innovation in Higher Education, Technology-enhanced learning	-
4.	A Quantitative Cost Effectiveness Model for Web-Supported Academic Instruction	Cohen, A and R Nachmias (2006)	Quantitative	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Web-based instruction, Cost-effectiveness model, Online learning, Policy	-
5.	Implementing a Cost	Cohen, A and	Quantitative	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost effectiveness,	-

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Effectiveness Analyzer for Web-Supported Academic Instruction: A Campus Wide Analysis	R Nachmias (2009)					campus wide analysis, pedagogical benefits, Web supported learning, blended learning, Higher Education	
6.	Cost-Benefit Analysis: Case Study of the Distance Master of Science Program in the Department of Instructional Systems Technology, Indiana University.	Parker, P, G Kapke, MD Subude, B Ludwig and A Van Hoogstraat (2001)	Evaluation/Case Study	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Computer Assisted Instruction, Computer Mediated Communication, Cost Effectiveness, Costs Distance Education,	Cost-effectiveness of Distance Learning
7.	Final Report: Cost-Benefit Analysis. Case study of the M.S. Distance Education Program in the Department of Instructional Systems Technology, Indiana University	Van Hoogstraat, A, B Ludwig, B Su, G Kapke, M Doo and P Parker (2005)	Evaluation Report/ Case Study/ Quantitative	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Computer Assisted Instruction, Computer Mediated Communication, Cost Effectiveness, Costs Distance Education,	-
8.	Web-based	Bates, A.W.	Case Study	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost Effectiveness, E-	-

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Learning: Costs and Ogranisational Issues. Technology, E-Learning and Distance Education.	(T.) (2005)					learning Strategies	
9.	A System-Level Comparison of Cost-Efficiency and Return on Investment Related to Online Course Delivery	Ramage, T (2005)	Evaluation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost-efficiency, Return of Investment, Distance Learning, Online Learning	-
10.	Counting the Cost. Strategies for Sustainable Open and Distance Learning	Perraton, H and G Naidu eds. (2006)	Case Study	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost-efficiency, Costing, Return of Investment	-
11.	A Blueprint for Transformational Organisational Change in Higher Education	Nicol, D and S Draper eds. (2009)	Case Studies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cost-effectiveness, Costing, Technology Enhanced Learning	Cost-effectiveness of Blended E-learning/ Student Performance
12.	Cost-Effectiveness Analysis of Computer-Based Assessment	Loewenberger, P and J Bull (2003)	Quantitative Research	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Economies of Scale, Cost-effectiveness, Computer Based Assessment, Workload	-
13.	Innovative Teaching:	Lück, M and G	Case Study	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost-efficiency,	-

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Sharing Expertise through Videoconferencing	M Laurence (2005)					Videoconferencing	
14.	Build Your Own Board: Brightboards Offer a Cost-Effective Alternative to Interactive Whiteboards	Vallis, K and P Williamson (2009)	Case Study	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost-efficiency, Educational Technology, Technology Integration	-
15.	Reusing Online Resources: A Sustainable Approach to E-Learning	Littlejohn, A (2003)	Collection of Case Studies/ Research Papers	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Learning Object, Open Educational Resources, Sustainability, Learning Object Repositories	Open Educational Resources and Learning Materials
16.	Learning Objects and the E-Learning Cost Dilemma	Weller, M (2004)	Case Study	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cost effectiveness, E-learning, Expenditure per student, Learning objects	-
17.	Podcasting for Learning in Universities	Salmon, G and P Edirisingha (2008)	Practitioner Resource/Guide	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Podcsting, Cost-Efficiency, Learning Objects,	-
18.	Cost-Effective Distributed Learning with Electronic Labs	Campbell, JO, PJ Mosterman, H Marcinkiewicz and M Wang (2004)	Case Study	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Virtual Laboratories, Cost-Effectiveness, Learning Design	-
19.	Learning Efficacy	Annand, D	Mixed Method	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	E-Books, Cost-	Affordable

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	and Cost-Effectiveness of Print Versus E-Book Instructional Material in an Introductory Financial Accounting Course	(2008)	Research				Effectiveness, Electronic Resources,	Technologies
20.	Teaching without a Textbook: Strategies to Focus Learning on Fundamental Concepts and Scientific Process	Klymkowsky, MW (2007)	Case Study	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Electronic Resources, Printed Books, Costs, Cost-Effectiveness	-
21.	A Summary of Disagreements with the "Mere Vehicles" Argument	Clark, RE (2001)	Meta-Analysis	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Student Performance, Online/Face-to-Face Learning, Learning Outcomes, ICT in education	No Significant Difference Phenomenon
22.	Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies	Means, B, Y Toyama, R Murphy, M Bakia and K Jones (2009)	Meta-Analysis	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Student Performance, Online/Face-to-Face Learning, Learning Outcomes, ICT in education	-
23.	Investigating Students' Perceived Satisfaction,	Liaw, SS (2008)	Case Study	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	E-learning; Satisfaction; Intention; Effectiveness; The Blackboard; TAM; 3-	Student Acceptance and

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Behavioral Intention, and Effectiveness of E-Learning: A Case Study of the Blackboard System.						TUM	Perceptions of Quality
24.	Determining Factors of the Use of E-Learning Environments by University Teachers	Mahdizadeh, H, H Biemans and M Mulder (2008)	Quantitative Research	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Computer-mediated communication; Cooperative/collaborative learning; Distance education and telelearning; Media in education;	-
25.	Comparing Dropouts and Persistence in E-Learning Courses	Levy, Y (2007)	Quantitative Research	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Dropout rates; e-Learning; Student satisfaction; Academic locus of control; Persistence in e-learning courses	Student Retention
26.	Using Blended Learning to Improve Student Success Rates in Learning to Program	Boyle, T, C Bradley, P Chalk, R Jones and P Pickard (2003)	Case Study	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Dropout rates, Student Retention, Blended Learning, Learning Design	-
27.	Learners' Acceptance of E-Learning in South Korea: Theories and Results	Lee, BC, JO Yoon and I Lee (2009)	Quantitative Research	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	E-learning, Service quality, Playfulness, Technology acceptance	New Technologies and Usability
28.	Mobile Learning: A	Motiwalla, LF	Quantitative	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mobile learning, Learning	-

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Framework and Evaluation	(2007)	Research				communities, Cooperative/collaborative learning, Distance education and tele-learning	
29.	Advancing the M-Learning Research Agenda for Active, Experiential Learning: Four Case Studies	Dyson, Litchfield, Lawrence, Raban and Leijdekkers (2009)	Case Studies	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mobile learning, Experiential Learning, Economic Sustainability	-
30.	The Effectiveness of M-Learning in the Form of Podcast Revision Lectures in Higher Education.	Evans, C (2008)	Quantitative Research	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Adult Learning, Distance Education, Evaluation of CAL Systems, Teaching/ Learning Strategies	
31.	Improving Learning and Reducing Costs	Twigg, CA (2003)	Case Studies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Cost Effectiveness, Curriculum Design, Higher Education, Online Courses, Web Based Instruction	Transformative Change
32.	Redesigning Teaching and Learning in Higher Education Using Ict: Balancing Quality, Access & Cost.	Twigg, CA (2003)	Case Studies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Cost Effectiveness, Curriculum Design, Higher Education, Online Courses, Web Based Instruction	-
33.	Sustainability	Gunn, C	Qualitative/Inter	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	E-learning Sustainability,	-

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Factors for E-Learning Initiatives	(2010)	pretive				E-learning Strategy, Integration, Dissemination	
34.	Bridging the Gap between Policy and Practice: A Framework for Technological Intervention.	Conole, G (2010)	Review/Position Paper	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Education Policy, E-learning Policy, Technology for Education,	Evolutionary versus Revolutionary Change/E-learning Policy
35.	Does E-Learning Policy Drive Change in Higher Education?: A Case Study Relating Models of Organisational Change to E-Learning Implementation.	De Freitas, S and M Oliver (2005)	Case Study/Position Paper	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	E-learning policy, E-Learning Implementation/Change, Change Models	E-learning Policy
36.	Implementing a University E-Learning Strategy: Levers for Change within Academic Schools	Sharpe, R, G Benfield and R Francis (2006)	Case Study	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	E-learning Strategy, Institutional Change, Technology Enhanced Learning	Sustainable Educational Leadership
37.	Innovating Education with an Educational Modelling	Sloep, PB, <i>et al.</i> (2006)	Two Case Studies	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Educational Innovation, Institutional Change, Change Management	-

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
	Language: Two Case Studies							
38.	Role of Instructional Technology in the Transformation of Higher Education	Garrison, DR and Z Akyol (2009)	Position Paper	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Collaborative constructivism, Collaborative leadership, Community of inquiry, Instructional technology, Web 2.0	-
39.	Communities of Practice: Creating Learning Environments for Educators	Kimble, C, P Hildreth and I Bourdon (2008)	Collection of Case Studies/Research Papers	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Communities of Practice, Teacher Education, Teacher Development	Communities of Practice
40.	A Systemic Framework for Managing E-Learning Adoption in Campus Universities: Individual Strategies in Context	Russell, C (2009)	Case Study	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Communities of Practice, University Environments, Exchange, Innovative E-learning	-
41.	Learning Networks for professional development of university staff	Brouns, F., Berlanga, A., Fetter, S., Bitter-Rijkema, M., Van Bruggen, J., & Sloep, P	Evaluation/Quantitative	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Social Networks, Professional Development,	Professional Networks

No.	Name of the Paper	Author/Year	Type/Method	Operational Domains			Keywords/Descriptors	Allocated Theme
				RM	EA	PDI		
		(In Press)						
42.	Coalition Formation in Networked Innovation: Directions for Future Research	Sie, R, M Bitter-Rijkema and P Sloep (2009)	Position Paper	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Networked Innovation, Professional Networks	-
43.	Emerging Research Topics in Social Learning	Klamma, R (2010)	Case Studies	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Learning networks, social network analysis, network visualization, recommender systems	-
44.	Supporting Instructors in Innovation: A Three-Component Approach	Margaryan, A (2008)	Conceptual Paper/Empirical Study	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Human resource management, Knowledge sharing, Teachers, Workplace learning	Teacher Development and Training
45.	Faculty Development for New Technologies: Putting Mobile Learning in the Hands of the Teachers	Lefoe, G, IW Olney, R Wright and A Herrington (2009)	Qualitative Research	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Mobile Learning, Faculty Development, Teacher Training	-
46.	Approaches to Learning Design: Past the Head and the Hands to the Heart of the Matter	Donald, C, A Blake, I Girault, A Datt and E Ramsay (2009)	Qualitative/Iterative	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Learning Design, Pedagogical Dimensions, Teacher Beliefs, Visualisation, Reusability	-